The Determinants of Territorial Conflict in Africa: A Geospatial Approach

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ABSTRACT

This paper explores the determinants of territorial conflicts among African states using a novel geospatial data set that maps disputed and undisputed borders. The geospatial approach helps eliminate problems of aggregation and selection on the dependent variable in studies of territorial conflict, as well as permitting fine-grained analysis of the local determinants of disputes. The data are used to test several hypotheses pertaining to the partitioning of ethnic groups, the presence of natural resources, natural vs. artificial borders, and state power. We find that border segments that partition ethnic groups are at higher risk of conflict only when the ethnic group is dominant, politically and demographically, within the state or has a high level of political centralization and that these effects are most pronounced early in the life of the state. The presence of oil or mineral deposits does not systematically increase the risk of a dispute, while river borders are less likely to be contested. The results suggest that territorial claims were, in large part, a tool for governments in newly-independent states to build support among politically important groups and to build ethnically-based national identities in relatively homogeneous states.

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We live in an international system with a distinct territorial order. Territorially circumscribed states and leaders of such states remain the most prominent actors. When this territorial order is threatened or questioned, the resulting disputes typically are the most deadly and long-lasting conflicts (e.g., Vazquez 2009). The study of territorial disputes has thus rightly become an important research agenda in international relations. Progress, however, has been limited because of two related conceptual roadblocks. First, scholars tend to focus on the consequences and not the origins of these disputes. Second, almost all research focuses on the characteristics of the contending states, rather than on the characteristics of the territory or border at issue. A cursory look at maps, however, reveals that most often territorial claims are for very specific and limited areas or sections of the border. In other words, there exists significant variation not only in which states have territorial conflicts but also in the extent and location of contested sections along a given border. A focus on *which* territory and *which* parts of a border are contested can help explain the origins of territorial disputes, why states and leaders dispute some parts but not others, and why these pieces of territory are so valuable that they are worth fighting and dying for.

This paper makes two contributions toward addressing this challenge. First, we introduce a new data set based on a geospatial coding of territorial claims in post-independence Africa. We aim to show that the use of geographic information systems (GIS) advances the study of territorial conflict because it allows a more fine-grained analysis of the characteristics of disputed and undisputed regions. Second, we use this data set to explore several prominent hypotheses about the determinants of interstate territorial conflict, with particular attention to the issue of nationalism and political (re-)

unification, topics of prominent literatures in their own right. Specifically, we focus on the role of partitioned ethnic groups, a prominent feature in many explanations for conflict in Africa. By virtue of their externally imposed and often artificial nature, most borders in Africa cut through ethnic or linguistic groups. And yet, border conflicts are relatively rare, suggesting that the effect of ethnic partition, if any, must be contingent on other factors. We explore several hypotheses that speak to this conditional effect of ethnic partition, while we also consider other potential determinants of territorial conflict, such as the presence of natural resources or the extent to which borders coincide with physical barriers, such as rivers or mountains.

Our main findings can be summarized briefly:

- The effect of group partition is highly conditional on the group's size and political influence, which we proxy in a variety of ways. While the partitioning of large groups with political access is a risk factor for conflict, the partitioning of smaller or politically marginal groups decreases the risk of conflict (relative to that over border segments that do not partition a group).
- The effect of group partition is also conditional on the group's institutional capacity or degree of centralization. The partitioning of more centralized, state-like groups is more dangerous than the partitioning of decentralized groups.
- Both of the aforementioned effects are strongest in the decade after independence, suggesting that territorial claims on behalf of politically important groups are part of strategy of consolidating rule and/or building a national identity in a young state.
- There is no systematic evidence that the presence of oil or mineral deposits increases the likelihood of territorial conflict.

- There is some evidence that natural borders, in the form of rivers, lower the likelihood of disputes, but straight-line borders, a common feature in Africa, do not have a higher risk of conflict, once demographic factors are taken into account.

1. Conflicts over Territory: Literature Review

Although there has been a great deal of literature on territorial disputes, their escalation, and resolution, comparatively little has been written about their origins: that is, why some neighboring states have disputes over (parts of) their common border while others do not. Huth (1996, chap. 4) offers the most systematic data and analysis on this question, using an original global data set of territorial disputes. Huth finds that the strategic value of territory and political unification (whether the populations of the challenger and target share ties of a common language and ethnicity) play the most important role in the initiation of a territorial dispute, while the economic value of the territory (the presence of natural resources with export value within/proximate to bordering territory, or access to a port outlet) had the third largest impact. Somewhat surprisingly, ties to bordering minorities (whether bordering minority groups within the target share ties of language and ethnicity with the population of the challenger) had no statistically significant effect. In contrast, we find weak or no effects about the presence of natural resources but do find strong and consistent – but conditional – effects of partitioned groups.

A number of studies have examined border disputes in the more restricted domain of Africa (e.g., Widstrand 1969; Touval 1972; Boyd 1979; Englebert et al. 2002). Of these, the most comprehensive is Touval (1972), who qualitatively examines all of

Africa's borders. Unfortunately, but not surprisingly, he has little systematic to say about the non-disputed borders or border segments. Indeed, selection on the dependent variable, through a focus only on cases with disputes, is common in the qualitative literature. Englebert et al. (2002) offer the most sophisticated quantitative analysis of African border disputes to date, using a data set that includes the full population of cases. They find that the greater the proportion of the dyad's populations that is partitioned by borders, the greater the risk for conflict. However, contrary to what we report here, they find no effect associated with the institutional characteristics of the partitioned groups.[1] They also find some evidence that borders along straight lines, interpreted as an indicator of arbitrariness, increase the risk of conflict.

Both Huth (1996) and Englebert et al. (2002) use the dyad, or pair of neighboring states, as the unit of analysis. This means that the dependent variable codes whether or not those states had a dispute *anywhere* along their border, without capturing how much of the border was contested or *which* portions were contested. Moreover, all independent variables, by necessity, are measured at the dyadic level. This is not a problem for variables that do not vary by location along the border, such as the states' regime types, whether they share the same colonizer, or the balance of military capabilities (though there may be variation along the border in the ability to project military capabilities; see Herbst 2000). But any factors that vary along the border must, in this set-up, be aggregated up to the dyadic level. For example, when analyzing the effect of partitioned

[1] They claim support for their Hypotheses 1 (p.1099): "The greater the degree of dismemberment and the more politically centralized the partitioned groups, the greater the likelihood of disputes." But then immediately note a lack of support for the part about politically centralized groups. However, it is very difficult to understand how they attributed "political centralization of the partitioned groups" to the dyad level. Presumably the values for political centralization of the different portioned groups were in some way aggregated. This would not have been an easy task and one which introduces problems we discuss in detail below.

groups on border disputes, Englebert et al. (2002) calculate the share of population in each state that belongs to groups partitioned by the border and then averages these shares to get a dyadic value.

There are two potential shortcomings to this kind of aggregation. The first is that information is bound to be lost by averaging or summing values across multiple groups partitioned by different segments of the border. Second, an ecological inference problem can arise when aggregated attributes of the entire border are used to explain disputes that may take place over only a subset of the border. For example, even if a substantial share of the population of two states is partitioned by a border, it is possible that the contested segments partition a relatively small group or none at all; if so, it would be a mistake to infer that the dispute was due to the size and influence of the partitioned population. The same problem occurs when Englebert et al. (2002) employ an indicator for whether a boundary contains any straight lines, and find that this variable is positively associated with the risk of conflict. In cases in which the border contains a mix of straight and non-straight segments, there is no way to confirm that the straight portions were the ones actually contested.

Huth (1996) addresses this problem partially, because he identifies the disputed regions and codes independent variables – such as the presence of natural resources or ethnic kin – as they apply to that region. However, he cannot do the same for the null cases, of which there are two kinds: dyads in which there is no dispute and dyads which dispute some, but not all, of their border. For the former, the independent variables reflect aggregates across the whole border; for the latter, uncontested portions of otherwise contested borders are ignored in the analysis. Thus, to the extent that relevant

features may vary along the length of a border, dyadic level analysis has clear shortcomings. Most prominently, we would argue, dyadic level analysis makes it difficult if not impossible to explain why certain areas and sections of the border are contested, while others are not, thereby making it impossible to understand what makes some pieces of territories, but not others, worth risking a fight over.

2. Mapping Territorial Conflicts

The central methodological innovation of this paper is a geospatial data set that maps interstate territorial claims in post-independence Africa. In this section, we motivate the selection of the case and describe the process of mapping the disputes.

Why Africa?

In principle, the methods we employ here could be used to explore territorial conflicts anywhere in the world, even if some specifics might vary. Africa might appear to be an odd place to start in large part because the continent experienced relatively few territorial disputes in its post-independence history and, indeed, has generally experienced fewer interstate conflicts than other regions (see, e.g., Lemke 2002). In 1964, the Organization of African Unity (OAU) officially endorsed the norm that colonial-era borders would be respected, a decision that reflected the widespread sense that opening up the issue of the continent's externally imposed borders would unleash widespread conflict (see also Zacher 2001). Indeed, in spite of the sizable number of territorial disputes we identify, there is only one case (Mali-Mauritania) in which a

significant territorial revision took place.[2] The relative lack of territorial conflict may also reflect the weakness of most African states, many of which have a hard enough time controlling the territory already under their de jure sovereignty (Herbst 2000).

That said, there are several advantages to focusing on Africa. In an ideal experimental setup, we would drop boundaries from the sky and let them fall randomly without regard to conditions on the ground. We could then see which of these randomly imposed borders were contested and which were not. That is not exactly what happened in Africa, but it is the region of the world which most closely approximates this experimental ideal. While it is too strong to say that European powers divided the continent with no regard for the people or land, the lines they drew have a largely arbitrary character, often reflecting the needs and ambitions of the colonial powers, rather than the people living there. As a result, African borders provide opportunities for natural experiments (Posner 2006).

The fact that most African states attained independence around the same time, in the early 1960s, also means there is a natural starting point for observing subsequent behavior of a large number of states, all of whom faced a similar international environment and similar imperatives to build post-colonial polities. This is particularly important when examining the importance of claims based on (re-) unification of partitioned ethnic groups. While such claims are found all over the world, they are notoriously hard to evaluate (Huth 1998; White 2000; and a large literature in political geography such as Johnston, Knight and Kofman 1988, Agnew 1994; Anderson 1998;

[2] Libya managed to exercise de facto control of Chad's Aouzou strip during the 1970s and 80s, but its claim to the region was rejected by the ICJ in 1994, and it subsequently departed. Morocco has exercised de facto control of Western Sahara since the late 1970s, but the annexation is not generally recognized. The secessions of South Sudan and Eritrea were not the product of international disputes.

Herb and Kaplan 1999; White 2000; and Yiftachel 2001). National identities are influenced by the process of boundary making (see, e.g., Sahlins 1989), and the spatial distribution of groups can change endogenously as people move in response to boundary changes, either voluntarily or otherwise. Large-scale population transfers, as occurred after World War I and World War II, are unfortunately relatively common consequences of conflict. The African experience presents the analyst with distinct advantages in this respect. Pressures to move to one's appropriate ethnic or national "homeland" were relatively mild in the age before the independent African states emerged. As a result, we can be confident that ethnic settlement patterns—which, as discussed below, we can map before or near the time of independence—were not driven by the new international borders or, at minimum, were less so than in Europe.

Finally, though we recognize the importance of the norm expressed in the OAU's Cairo Declaration, we also note that this norm does not eliminate all interesting variation. Some states (e.g., Somalia) exempted themselves from the declaration; others found ways to articulate territorial claims in ways that were consistent with the norm (e.g., by citing ambiguity in the colonial-era boundaries); and others ignored the norm altogether (e.g., Lesotho). And in spite of the fact that these claims seldom led to actual changes in territory, that does not mean they were inconsequential or without welfare effects. Two thirds of the disputes in our data set were accompanied by at least one interstate militarized incident, and in about half of those disputes, there were significant (>100) casualties. Most cases also led to occasional or sustained economic disruptions due to border closures.

Identifying and Mapping Disputes

Consulting a variety of sources, we identified cases in which neighboring states had incompatible territorial claims and then researched the location and extent of those claims.[3] To be coded as an interstate territorial dispute, these claims had to be advanced by central state governments and pursued using diplomatic and/or military means. In some cases, disputes were inherited from the colonial era, but to enter the data set, they had to be reiterated by the states after independence.[4] Moreover, we sought to identify disputes that represented incompatible claims, rather than technical issues arising from poorly delimited or demarcated borders. There are a number of instances in which states sought to clarify their borders, usually through the appointment of mixed commissions. We did not code such cases as disputes unless and until there was some diplomatic or military act that signified an incompatibility pursued at the political, rather simply technical, level. To eventually mesh these data with existing Correlates of War data sets, we restricted the collection to disputes arising no later than 2001, which means that the conflict between Sudan and South Sudan is not reflected in our data set.[5] Using these criteria, we identified disputes along 27 of the 102 borders in northern and sub-Saharan Africa. There are 30 distinct disputes, since three dyads—Cameroon-Nigeria, Mali-Mauritania, and Morocco-Mauritania—had two separable disputes.

After identifying disputes, we researched the extent of the claims and mapped them using *ArcMap* software. To do so, we consulted a variety of sources to understand

[3] The main sources to identify claims were Calvert (2004), Huth and Allee (2002), Touval (1972), Brownlie (1979), Waters (1969) and the *International Boundary Study* series produced by the U.S. Dept. of State. Only land disputes were considered, meaning that several disputes about maritime boundary and off-shore islands have been excluded.

[4] This is important because there are cases in which a state pursued a border claim prior to its neighbor's independence but then dropped the claim once the latter attained independence (e.g., Liberia-Guinea).

[5] Similarly, a recent dispute between Kenya and Uganda over islands in Lake Victoria has been excluded.

which pieces of territory were under dispute. Often, claims coincide with an administrative division (e.g., the North Eastern Province in Kenya) or a physical feature (e.g., the Kagera River in Tanzania). In other cases, we obtained, scanned, and geo-referenced maps which detailed the claims. Maps were particularly likely to be available when disputes were handled by a judicial body such as the International Court of Justice, in which case maps of the disagreement often accompany court proceedings. Details on each dispute, along with a description of the map data and sources used, can be found in the appendix.

This research allows us to spatially render these disputes several different ways. First, we can think in terms of claim lines: these are the lines corresponding to where a state believes the border should be, when that is different from the status quo (which in this context refers to the lines inherited from the colonial period). Second, we can think in terms of claimed or disputed regions: these are polygons corresponding to the regions that were the subject of conflicting claims. Finally, we can think in terms of contested border segments: these are the segments of the status quo border that one or both states would like to replace with a claim line.

In principle, these three conceptions of a dispute are identical in the sense that they co-determine one another: contested segments are defined by where the claim lines hit the status quo border and contested regions are the polygons enclosed by the claim lines and the contested segments. In practice, however, it was sometimes easier to identify one element than the others. In 22 cases, we were able to precisely identify the lines that defined a claim: seven follow a physical feature like a river, eight follow current or former administrative boundaries (either internal or colonial), and seven follow

precisely specified map data or coordinates. In the eight remaining cases, we could identify general regions whose bounds were not precisely spelled out. The most common source of uncertainty arose when states claimed historical or ethnically-defined regions without specific borders (e.g., Somali-inhabited regions of Ethiopia, the Sanwi Kingdom in Cote d'Ivoire). In a small number cases, it was easier to identify the contested segments than the claim line; for example, in Morocco-Algeria, we know that the dispute centered around the undefined border south of Figuig, but the exact extent of the Moroccan claim was unclear. Figure 1 shows a map with the contested segments marked in red and the disputed areas in grey (note that some disputes are so small that they are not visible on this map).

In this paper, all of the analysis is performed on the contested segments, and we will be asking why some segments of the borders inherited upon independence became the subject of disputes and others did not. In the main analysis, we divide each border into 1km-long segments and code whether or not each segment was contested. In supplementary analysis reported in section 6, we use longer segments defined by ethnic characteristics. In the main analysis reported here, there is no time component to the data, so the dependent variable records whether or not the segment was ever contested in the post-independence period. We did, however, record a start date for each dispute, and we know dates of militarized conflicts. This will permit later analyses with a time dimension, including a test, reported here, that compares disputes that arose before or after the first decade of the border's existence.

The focus on contested segments is necessitated by the practical need to identify the population of cases that were at risk of being disputed. There are, in principle, a

bewildering number of claim lines that states could advance and or regions that they could claim. By contrast, the extent of the inherited border is fixed and finite, making the set of segments that could possibly be contested more manageable. While this approach has several desirable properties, it also has some notable shortcomings. First, the outcomes in contiguous segments along the same border are not independent of one another. The nature of territorial claims is that they are not randomly scattered along a border, but tend to be contiguous. Thus, the probability that any given 1km segment is contested is highly correlated with whether or not the neighboring segments on either side are contested. In the main analysis, we correct for non-independence by clustering standard errors; in section 6, we model the spatial dependence explicitly by using a regression with a spatial lag. A second limitation that arises from our focus on contested segments is that we lose information about the "depth" of the territorial claim. In other words, we lose the distinction whether a state claims territory just beyond or thousands of kilometers beyond the contested segments. Thus, we may overlook the determinants of the claim if these determinants lie deep within the neighbor's territory, not near the contested border itself. For the analysis of group partitions, this does not present a serious problem, since we care whether or not the segment cuts through a region inhabited by a particular group. While a group could conceivably be partitioned by a border but not be located at the border itself, this does not appear to be common. When we look at the role of natural resources, like oil or minerals, one might be concerned that the presence of resources could lead to a claim deep in the neighbor's territory, even if those resources are far from the contested segments. To deal with this, we code for resources within 50km of a segment.

3. Hypotheses

Four sets of arguments appear prominently in the literature on territorial disputes in general and African disputes in particular. The first emphasizes the effect of partitioned or "dismembered" ethnic groups, a feature that is common to African boundaries (e.g., Michaelopolis and 2011; Englebert et al. 2002; Asiwaju 1985; Boyd 1979). The second emphasizes the role of natural resources, particularly mineral wealth (Huth 1996; Okumu 2010). A third focuses on the effects of incompletely delimited or poorly demarcated borders (Carter and Goemans 2011). A final set of arguments emphasize variation in state power both relative to neighboring states (Huth 1996) and in ability to exert control over territory (Herbst 2000). We draw hypotheses from each of these sets of arguments and discuss how they are operationalized in empirical tests. In doing so, we do not intend to imply that these arguments are mutually exclusive. Indeed, each plays a prominent role in at least some cases. The goal is to determine which set of factors best accounts for the variation in the data when controlling for the others.

Partitioned Groups

The idea that territorial changes might be demanded in order to unify a group that would otherwise be split across multiple states echoes the European experience. There certainly exist cases in the African context that have this character: Somali irredentism against Ethiopia and Kenya, the push for Ewe unification in the conflict between Ghana and Togo, Morocco's and Mauritania's claims to Western Sahara. At the same time, partitioning cannot be sufficient to cause territorial claims simply because partitioning is

ubiquitous while disputes are relatively rare.

Figures 2 and 3 illustrate this point using the two maps that we rely on to geo-locate African ethnic groups around the time of independence. The first is Murdock's (1957) tribal map, which was digitized and made available by Nathan Nunn. The second is the Soviet 1960s era atlas *Narodov Mira*, which was digitized by Weidmann, Rød, and Cederman (2010) into a data set called GREG (Georeferencing of Ethnic Groups).[6] Given the variety of ways in which groups can be defined and identified, the two maps differ in some important respects. Because the identification and mapping of African groups is bound to be imperfect, the reliance on two distinct maps helps ensure that any result is not a product of a particular mapmaker's biases. Figure 2 shows the Murdock map, and Figure 3 shows the GREG map, with the contested border segments shown in red.[7] A glance at these maps reveals immediately that partition alone cannot be a strong risk factor for contestation because about 70 percent of Africa's borders, by length, partition a group identified on these maps, whereas only 18 percent of border segments are contested. Moreover, as we will see below, cross tabulations show no strong and consistent correlation between partition and contestation. This suggests that whether partitioned groups increase the risk of dispute is contingent on other factors.

Not every government has an interest in unifying every partitioned group, and not every partitioned group wants to be unified within the boundaries of a single state or can effectively press its case. Governments would prefer to bring into the polity groups that

[6] Notably, we make one major correction to the GREG data. The Soviet atlas and GREG in particular create ethnicities on the bases of international borders when they classify Arabs into Algerian Arabs, Moroccan Arabs, Tunisian Arabs, Western Saharan Arabs, Egyptian Arabs, Sudanese Arabs, Libyan Arabs, etc. and define their homelands (largely) according to the state borders. We aggregated these supposedly distinct groups into one category: "Arabs." None of our main results change when we use the original GREG classification.

[7] It should be noted that in no case did we use these ethnic maps to draw claim lines, even when claims were articulated in ethnic terms.

will add to their political strength or, relatedly, groups whose interests they want to be seen as advocating. This condition is most likely to be met when a single group is already dominant within the polity, so that the government benefits from inclusion of more ethnic kin and faces little effective resistance from other groups whose position will thereby be eroded (Horowitz 1985, 282). Even if demands for unification are unlikely to be successful, irredentist claims can be part of strategy of ethnic mobilization that provides political benefits to leaders from a dominant group. As Horowitz (1985, 283) points out, there is no guarantee that everyone in the irredenta will want to be redeemed, but acquiescence seems most likely when the group is assured a strong position in the state. Thus, claims designed to unify partitioned groups are most likely when that group is politically strong and demographically dominant within the country.

By contrast, governments are unlikely to advocate for the inclusion of marginal groups or groups that are expected to be politically hostile. In addition to the obvious disincentives to increasing the ranks of political rivals, there are costs to increasing heterogeneity within the state. This cost of state expansion is emphasized by Alesina and Spolaore (2003), and numerous studies confirm that ethnic diversity can harm economic growth and public goods provision (Easterly and Levine 1997; Alesina, Baqir, and Easterly 1999). Peripheral or disfavored groups may even prefer to have a presence in multiple states, giving them exit options if conditions in one country get too bad.

While it makes sense that segments that partition politically powerful groups are at greater risk of being contested than are segments that partition politically marginal groups, it is less clear ex ante how the latter compares to segments that do not partition any group. One possibility is that partition is dangerous because it creates a pretext for

territorial expansion. Certainly, there are cases in which demands for territory have been justified on the grounds that they would reunite groups that were politically marginal (e.g., the Kenyan claim to the Ilemi Triangle in Sudan, which rests on the stated aim of uniting the Turkana, a small and peripheral group). Alternatively, the partitioning of marginal groups may be pacifying, because neither the government nor the group has an interest in the latter's unification.

We operationalize these considerations several different ways. First, all models contain a measure of how ethnically diverse the states in the dyad are. We use the ethnic fractionalization score for each country, as derived from the Soviet atlas and calculated by Fearon and Laitin (2001). Since the data are organized around dyadic border segments, we use the lower of the two scores in the dyad, so the dyadic score decreases as at least one of the states in the dyad become more homogeneous. If more homogenous states have less disincentive to grow (Alesina and Spolaore 2003), then this variable should be negatively associated with the risk of a dispute on the border.

Second, we create a variable indicating, for each border segment, whether or not that segment partitions a group.[8] This coding is based on three versions of the two ethnic maps mentioned above: the basic Murdock map (Murdock_NS) and "snapped" versions of the Murdock and GREG maps (Murdock_S and GREG_S), in which the edges of the polygons were moved (snapped) to the national borders wherever those edges were within 10 kilometers of a border. We use snapped versions for two reasons. First, the ethnic regions must necessarily be drawn with less precision and nuance than is the case for state borders. This is not surprising, given the detailed cartographic information that is

[8] The GREG map identifies some mixed regions, containing two ethnic groups. Thus, a small number of border segments partition two groups.

needed to draw a very precise map of ethnic settlement patterns. By snapping the ethnic line to the border, we allow for some error in the ethnic map, with a reasonable level of tolerance. Second, by snapping the ethnic line to the border if it fell with 10 kilometers of the border, we ensure that groups are only classified as partitioned when they extend significantly into both countries. Additionally, the creators of GREG snapped the ethnic lines of the Soviet map to the international borders as specified by the Digital Chart of the World, an obsolete map housed at Penn State, which now explicitly notes that this data is unreliable. Some adjustment was therefore necessary to make the GREG map compatible with the international borders we used, which were provided by Natural Earth.[9]

For each partitioned group, we coded a series of variables indicating the group's size and political importance. In particular, we code (1) the group's share of the population (specifically, the maximum of its population share in the two states in the dyad), (2) the fraction of the border that partitions the group, (3) whether the group's territory includes the national capital of either state in the dyad, (4) whether the first leader of either state in the dyad came from that group.[10]

Finally, when using the Murdock group classification, we can include variables that capture the group's level of political centralization. There is a great deal of variation across groups in their pre-colonial political centralization. Some exhibit very weak institutionalization beyond the village level while other exhibit state-like control over a

[9] http://www.naturalearthdata.com/downloads/10m-cultural-vectors/. We corrected the mistaken line for the Ilemi triangle.

[10] We focus only on the ethnicity of the first leader since, as noted earlier, the data presented here do not vary with time, as the ethnicity of the leader does. We hope to add a time dimension in future tests. The identification of leader ethnicity was greatly aided by the data set produced by Fearon et al. (2007). We linked the groups identified by Fearon et al. to the groups in the Murdock and GREG maps.

significant areas. Several studies have shown that the pre-colonial political institutions affect development outcomes (Michalopoulos and Papaioannou 2011) as well as the likelihood of civil war (Englebert et al 2002). In their study of territorial conflict, Englebert et al. (2002) found no evidence that the partitioning of groups with state-like qualities was more likely to cause interstate disputes than the partitioning of "stateless" groups. However, their method relies on aggregation (through weighted averaging) across all groups partitioned by a given border, and hence can be susceptible to the problems noted above. The coding of group characteristics comes from Murdock's (1967) *Ethnographic Atlas*. The groups' political capacity and extent is coded using a 5-point scale that records the number of jurisdictional units the groups had above the village level. From this 5-point scale we create three dummy variables indicating village-level organization (level 1), chiefdoms (levels 2 and 3), and state-like entities (levels 4 and 5).

The final factor we use to condition the effects of partitioned groups is time. Irredentist strategies are most likely to attractive as a state-building in the years after independence. This was a time when leaders tried to forge new state and national identities and sought legitimacy for their rule. In this context, claims based on ethnic unity or historic homelands, as well as rejection of colonial impositions, might have had particular value. Indeed, most territorial disputes in the data set (20 of 30) were coded as starting in the first 5 years after the states in question became independent, and many were articulated from the moment of independence.[11] We conjecture that the partitioning of ethnic groups was a more significant risk factor in this earlier period, whereas

[11] We code an interstate border as coming into existence once both states sharing the border become independent. Thus, borders are "born" at the later of the two independence dates.

boundary disputes that arose later the states' "lifetimes" were less likely to be rooted in claims for ethnic unification. To test this hypothesis, we create two alternative dependent variables, one which indicates whether a segment was disputed within the first decade of the border's existence (as an interstate border) and the second which indicates disputes that arose anytime thereafter.

Resources

A second set of hypotheses examines the effects of the presence of natural resources, particularly oil and mineral, in the border region (Huth 1996; Okumu 2010). The desire to acquire resource-rich areas prominently figures into some African territorial disputes, including those between Morocco and Algeria and the Bakassi peninsula dispute between Nigeria and Cameroon. There also exist disputes in which case histories refer to the role of "rumored" resources, as in the Hailab triangle between Egypt and Sudan.

Though the resource motivation makes intuitive sense, there are at least two reasons to be skeptical. The first is that mineral resources are rather common in Africa, while disputes are rare. The cases in which resources fuel a dispute are well-known, but all the cases in which resource-rich areas were not disputed often escape notice. This observation points to the value of statistical analysis, which systematically incorporates information about the non-events. A second, substantive reason to be wary of the resource argument, particularly as it pertains to oil, is that the presence of resources may create *dis*-incentives to contest territory. In the case of oil, most developing countries depend to some degree on foreign multinational firms to exploit oil resources, and these

firms may be scared away by conflict. Particularly when oil straddles a border, the benefits a grab for more may be offset by the costs of being unable to exploit what one already has. Thus, for example, the discovery of oil in a disputed zone between Algeria and Tunisia actually hastened the resolution of that conflict (Touval 1972, 254).

To test for the importance of resources, we use the geocoding of oil deposits provided by Lujala, Rod, and Thieme (2007) and the Mineral Resource Data System (MRDS), a geocoding of mines and mineral deposits produced by the US Geological Survey.[12] A segment was coded as having oil or mineral nearby if there was a deposit located with 50km of the segment. Note that this coding of resources does not capture other kinds of resources that a piece of territory might contain, such as water, fish, or arable land. As noted below, we include an indicator for whether the border segment runs along a river or lake, which may help capture access to water and fish, which have at times been the source of conflict (e.g., in the Lake Chad region between Nigeria-Chad and Nigeria-Cameroon, and in the Lake Malawi).

Characteristics of the Border

Carter and Goemans (2011) emphasize that borders serve a coordinating function, creating common knowledge among governments and citizens about where one state ends and another starts. Because of physical or historical circumstances, some inherited borders may serve this function better than others, thereby affecting the likelihood of subsequent disputes. To capture this consideration, we considered several variables relating to the nature of the border and its colonial origin.

- Does the border segment follow a river or lake? Rivers and lakes provide natural

[12] Available on-line at http://tin.er.usgs.gov/mrds/.

and easily identifiable barriers and thus may reduce conflict. On the other hand, rivers have a tendency to move and lakes to recede, which could cause problems. River boundaries can also cause disputes over islands within the river, as in the Benin-Niger and Namibia-Botswana disputes (Gleditsch et al. 2006).

- What was the elevation of the border segment? Segments at higher altitudes may coincide with hills or mountains, which are good physical barriers.
- Is the border segment part of a straight line? Straight line segments are particularly artificial, since they do not follow natural barriers or demographic features (Alesina, Easterly, and Matuszeski 2011). In addition, straight lines may serve as poor focal points around which to coordinate behavior, since they are rarely evident on the ground.
- Did the border originally separate colonies from different empires or did it serve as an intra-empire boundary? It is plausible that inter-empire boundaries were better specified, while intra-empire boundaries were less clearly delineated. This is certainly true of boundaries in French West Africa, which were often poorly specified and altered frequently in the colonial era.[13] We also include controls for borders between British colonies and borders between French colonies.[14]
- Was the colonial-era border clearly established? It is plausible that borders which were not clearly delimited in the colonial era would be the subject of conflict after independence. To determine this, we rely on the work of the US Dept. of State

[13] A small number of borders arose in agreements between a colonial power and an independent African state. These are the residual category in tests with controls for inter- and intra-empire boundaries.
[14] The omitted category here includes borders between states with different colonial parents and a small number of cases in which both states were Belgian colonies. There is, naturally, some overlap between this coding and the inter- vs. intraempire coding. Differences arose, however, when the border was established, say, between a British and German colony (thus, interempire), but the latter became British after WWI, and so both states are coded as having Britain as their parents.

Office of the Geographer in the *International Boundary Series* (IBS) reports. Some official US maps include disclaimers indicating that US government could not be sure of the border's location. A report listing these disclaimers was released in 1967, allowing us to identify border segments that the US government considered unclear or provisional.[15]

State and Dyadic Power

The last hypothesis we consider is that the extent of border claims depends on states' power to take and control territory, a variable that features prominently in IR theory and tested explicitly in the context of territorial disputes by Huth (1996). The relative power of the states is captured using a standard measure of the balance of capabilities in the dyad, based on the Correlates of War National Material Capabilities data. This variable equals the capability score of the weaker state divided by that of the stronger, and so it varies from zero to one, with higher values indicating more equally balanced dyads. If relatively more powerful states are likely to make larger claims, then this variable should have a negative effect on the likelihood that a given segment is contested. Given that capabilities vary with time, it is difficult to incorporate them into the cross-sectional model we have here. To cope with this, we measure the military balance at independence and at five and ten years after independence. Results reported

[15] There are two challenges with this coding. First, because the report was released in 1967, some borders that likely would have received disclaimers were already resolved. Second, some disclaimers were influenced by the presence of active disputes, and are thus endogenous to the outcome we are modeling. We attempted to adjust the codings to correct for these problems. Brownlie (1979) was useful in this regard.

below use the first measure, but similar results obtain using the later scores.[16]

Finally, Herbst (2000) argues that state capacity in Africa diminishes with distance from the national capital. If so, states may have little willingness or ability to assert claims of border areas that are very far from the capital. To test this, we calculate the distance from each border segment to the capitals of the two states and take the minimum distance as a measure of the proximity to a capital.

4. Empirical Patterns

The total area of the disputed regions adds up to 2.7 million square kilometers, which is about 9.5 percent of Africa's total area. The total length of the contested segments is 13,800 kilometers, which amounts to 18 percent of the total length of Africa's borders. As noted earlier, among dyads with a dispute, there exists significant variation in the extent of claims. Figure 4 depicts the variation in the area of contested regions measured as a percentage of the combined area of the two states. As the figure shows, the great majority of territorial disputes in Africa revolve around rather limited areas; only two involve demands for the outright annexation of an entire state. Similarly, there exists significant variation in how much of the status quo border is contested, as shown in Figure 5. Note that while there are seven cases in which the entire length of the border was contested, in only two of these cases were the claims for the entire territory of the one of the states; thus, in most of the cases in which the entire border was contested,

[16] Standard models of international conflict also generally include controls for alliance ties and regime type. We included such controls in some specifications and found no effects. As these are time-varying variables, it may be that our cross-sectional model has a hard time picking up their effects.

the claims did not go very deep.[17] These patterns are interesting in their own right, since they suggest that territorial claims are typically limited and bounded, rather than maximalist. The question of where these bounds come from has important implications for international relations theory and for understanding the world we live in, a topic we will take on in ongoing research.

The next two figures summarize information about the timing of these disputes. Figure 6 depicts each dispute by plotting the fraction of the border contested against the year in which the dispute started. As this figure shows, African territorial disputes not necessarily are a thing of the past, nor did they end with the 1964 OAU resolution. New disputes arose after this early post-independence period, several arising in conjunction with the independence of new states (e.g., Eritrea, Namibia) or the emergence of new land with the shrinkage of Lake Chad. The tendency for claims to arise early in the lifetime of the dyad is underscored by Figure 7, which plots the percentage of combined area contested against the age of the border when the dispute started. While early claims vary significantly in size, they tend to be larger than the later claims (with the one exception being Idi Amin's demands on Kenya, as noted). This is suggestive of a general pattern, which we probe later, in which early disputes revolve around politically salient territories with ethnic and historical importance, while disputes that arise later tend to be smaller and more idiosyncratic.[18]

We next turn to some bivariate relationships in the data. Table 1 presents the frequency of disputes as a function of the main dichotomous variables in the data set.

[17] In analysis not shown here, we find that there is *no* relationship between the percentage of the border that is contested and the severity of any ensuing militarized disputes.

[18] Schultz (2013) shows that disputes that arise early in the life of a dyad tend to experience higher risk of militarization that disputes that arise late, a finding that is consistent with the idea that the former are more politically salient.

Since the large number of observations (over 76000) ensures that even small differences are statistically significant, the main thing to consider in this table is the magnitude of the difference in disputes rates when a given attribute is present or not. The table also reports the percentage of segments that have each attribute.

Several patterns are evident in these data. First, there is neither a consistent nor a sizable bivariate relationship between whether a segment partitions a group and whether it is contested. A positive relationship between partition and dispute is evident in the two snapped maps, but the effect is not very large. Recall that the difference between the unsnapped and snapped versions of the Murdock map is driven by the fact that a group must extend at least 10km into both states for it to be considered partitioned in the latter. Thus, the switch from a negative to a positive relationship when moving from unsnapped to snapped suggests that disputes are more likely to be associated with groups that are dismembered by the border rather than those merely shaved by it. A stronger relationship emerges when we condition on whether the segment partitions a group that produced the first leader of one of the states in the dyad. The dispute rate is consistently increased by such a partition, particularly in the GREG_S map. Note that the frequency of 1st leader partitions is much higher in the GREG data than in the Murdock data, owing to the fact that Murdock groups tend to be smaller. The level of political centralization also has effects in the expected direction: segments that partition groups with only village-level organization are very unlikely to be contested, while segments that partition chiefdoms or state-like groups have higher dispute rates.

Several other bivariate relationships are worth noting. Straight line segments are contested at 2.5 times the rate of non-straight segments, while segments that follow rivers

are a contested at one-third the rate of segments that do not. There is no clear relationship between the presence of minerals and a border dispute, while the presence of oil within 50km of the segment actually decreases the likelihood of a dispute. Note that oil is very rare, and indeed only nine dyads have any border segments that are close to oil deposits. Segments separating former British colonies are contested at almost twice the rate than those that do not. Other variables have relatively small effects. We will see below that all of the bivariate relationships continue to hold in the multivariate tests with the exception of the finding with respect to straight line segments.

Finally, Figure 8 probes the hypothesis that relatively more powerful states can and will make larger demands. The figure plots the disputants' relative strength at independence to the percentage of their total area that was disputed (with zero indicating no dispute). While is true that the largest claims by area are made in highly unequal cases (Morocco-Mauritania, Ghana-Togo), large power imbalances are also often associated with little or no claim. Overall, this relationship is weak.

5. Multiple Regression Analysis

This section tests the hypotheses articulated above using multiple regression analysis. In all models presented in this section, the unit of observation is the 1km border segment, and the dependent variable indicates whether or not that segment was disputed. All regressions are estimated using a logit model. To relax the assumption of independence between individual segments within the same dyadic border, we calculate Huber-White standard errors clustered by dyad. Because there is a great deal of variation in border lengths, and thus the number of observations per dyad, all regressions include a

control for the length of the border in kilometers, logged.[19]

The Effects of Group Partition

Tables 2-4 present a series of models that explore the effect of group partitioning conditioned on indicators of group influence. Each table relies on group data from a different map (Murdock_NS, Murdock_S, and GREG_S). Within each table, five specifications are reported. All columns include a dummy variable for whether or not the segment partitions a group. Subsequent columns add interaction terms for whether the first post-independence leader in either state in the dyad was a member of the group partitioned by the segment; whether the homeland of the partitioned group includes the national capital of either state in the dyad; the fraction of the dyadic border that partitions the group partitioned at the given segment; the population share of the partitioned group, calculated by determining the share of the group's population in each country in the dyad and taking the maximum of these two shares. Thus, column (1) captures the unconditional effect of partition on the risk of a dispute, and the remaining four columns condition this effect on alternative measures of group influence.

Several things stand out from these tables. First, as in the bivariate results, there is no unconditional effect of partitioning on the likelihood of a dispute, as the coefficients on partition in the first columns are always insignificant. Second, in all three maps, the partitioning of a group that produced the first leader of one of the states in the dyad is positively and significantly associated with a risk of a dispute (column 2). Moreover, when using the GREG_S map (Table 4), all three other indicators of partitioned group

[19] To save space in what follows, we report regressions that drop the lake and elevation indicators, as these consistently had small and insignificant effects and there exclusion has no impact on the results.

size and influence also have positive and significant effects, as expected. Finally, ethnic fractionalization (of the least fractionalized state in the dyad) is strongly negatively correlated with dispute risk. Thus, consistent with Alesina and Spolaore (2003), the incentive to expand appears greatest in the most homogenous states. The coefficient in Table 4, column 2, implies that increasing ethnic fractionalization in the dyad from one standard deviation below to one standard deviation above its mean reduces the probability that a segment on the border will be disputed by 0.26.

To give a clearer picture of the effects of political power and partition, Figure 9 shows the predicted probability that a segment is disputed as function of whether it partitions a GREG group and whether the first leader of one of the states in the dyad came from the partitioned group. The estimates are based on Table 4, column 2.[20] As the figures show, the effect of partitioning is contingent on the group's access to power at the outset of independence. A segment that partitions a group that produced the first leader of one of the states in the dyad is considerably more likely to be contested than a segment that partitions a group that did not produce the first leader. The partitioning of politically weaker groups is less likely to provoke conflict than if the border segment does not partition a group at all; however, this latter effect is not robust across all models.

Substantively, we observe that the partitioning of a GREG group that produced a first leader played a substantial role in 15 of the 30 disputes in the data set. These are shown in Table 5. Moreover, while the data here are not directional, in the sense that they do not identify a challenger or target, a qualitative assessment shows that, in all but two of these cases, the leader of the partitioned group came from the state that was

[20] Predicted probabilities obtained using the national capital indicator are almost identical (Table 4, column 3), largely because there is very strong overlap between groups that produced the first leader and groups whose homeland contains the national capital.

challenging the status quo (shown in bold).

Figure 10 looks at the impact of group size using the estimates from Table 4, column 5. The horizontal line (and associated dashed lines showing 95 percent confidence intervals) shows that predicted probability that there will be a dispute on a border segment that does not partition a group. The upward sloping curve shows the probability of a dispute on a segment that partitions a group as a function of the group's share of the population in the state in which it is more populous.[21] We see that if a partitioned group comprises at least a majority in one of the states, then the risk of conflict over the partitioning segment is higher than over non-partitioning segments. At the low end, the predicted probability of conflict over small groups is less than the probability associated with segments that do not partition a group, although the difference is not statistically significant.

In Table 6, we examine the effects of political capacity measured in terms of the groups' pre-colonial degree of jurisdictional hierarchy (available on for the Murdock map groups). Two findings stand out. First, segments that partition groups with the lowest level of institutional hierarchy are significantly *less* likely to be disputed than are segments that do not partition at all. Second, using the snapped map to exclude marginal partitions, segments that partition chiefdoms and state-like groups are more likely to be disputed than segments that do not partition, though only the coefficient on chiefdoms is statistically different from zero. Figure 11 uses the estimates from column 2 to depict the predicted probability of a dispute as a function of whether a segment partitions a group and, if so, that group's jurisdictional hierarchy. Notice that segments that partition

[21] Since the ethnic fractionalization score is highly correlated with a partitioned group's share of the population, former was allowed to vary linearly with the latter while all other variables were held at their means or modes.

chiefdoms and state-like groups are significantly more likely to be contested than those that partition groups with no hierarchy beyond the village level.

Table 7 reports one final set of tests that shed light on the conditional effect of group partitions. Here, we replicate two of the specifications from above but with modified dependent variables that capture whether the segment was disputed within the first decade of the border's existence (dispute_early) or sometime thereafter (dispute_late). [22] The main thing to note is that the results regarding group partition are mostly evident in the first decade after independence. Although the negative effects associated with partitioning weaker groups are evident in the later period (columns 2 and 4), the risks associated with ethnic homogeneity and the partitioning of groups whose homeland include a capital city only appear in early disputes (columns 1 and 3). Non-ethnic variables, such as river boundaries and IBS disclaimers, are more relevant to the later disputes (though the relatively small number of late disputes means that all such results must be read with some caution). This suggests that the political salience of ethnic considerations was most pronounced in the early post-independence period, when leaders might have been tempted to use claims on behalf of important groups to solidify their rule and to bolster an ethnically-based national identity. If claims on behalf of such groups were not made in the early period, they were not particularly likely to be made later. In future work, we hope to explore these time dynamics more fully, by incorporating time-varying data on leaders.

The Effects of Resources

[22] In the event that a segment was subject to an early dispute, it is no longer at risk for a late dispute, so tests using dispute_late should be interpreted as estimated the probability of a late dispute conditional on the segment's not having been subject to an early dispute.

In almost all of our specifications we find no effect for the presence of minerals within 50km of a border segment. The only exception is in Table 7, where the presence of minerals is positively associated with the risk of a late dispute in one specification (column 4). The presence of oil has a consistently negative effect on dispute risk, particularly after the first decade following independence, when there is not a single case of a dispute involving segments near oil deposits. Thus, while there exist some well-known cases of disputes involving oil and mineral resources, their presence does not appear to be a general risk factor. Interestingly, there are a number of disputes in which "rumors" of oil or minerals play significant role in the case histories, but for which actual deposits do not appear on our maps. Whether this suggests a problem with our maps or something interesting about the role of rumored wealth is an open question.

The Effects of Border Characteristics

Segments that follow rivers are, on average, less likely to be contested than are segment that do not. This suggests that such "natural barriers" or alternatively easily identifiable and focal boundaries (Carter and Goemans 2011) produce, on net at least, a pacifying influence. This result obtains in spite of the fact that, in several cases, such bodies of waters did become the object of disputes (e.g., Benin-Niger, Namibia-Botswana). One surprising result is that the risk associated with straight line segments, evident in the bivariate tests, does not survive multiple regression analysis, particularly the inclusion of the ethnic fractionalization measure. Straight line borders tend to surround the most homogeneous states (i.e., in north Africa), so the correlation between these two variables is -0.32. Once we control for the fact that more homogenous states

are more likely to have disputes, the apparent effect of straight lines goes away. This suggests that the apparent danger of straight lines derives from the nature of the populations they enclose and divide, and not from the fact they are particularly arbitrary or have no "on the ground" referents.[23]

With respect to colonial legacies, we find that dyads in which both countries had British parents had a higher dispute risk overall. Interestingly, this does not seem to be a product of the fact that the British produced particularly vague or ill-defined borders, which was much likely to hold for the French. Our indicator for lack of clarity, the IBS disclaimers, shows them to be much more common in French West Africa. French parentage and IBS disclaimers have no systematic effect in the pooled data (Tables 2-4). The time-varying results in Table 7 suggest some impact of these variables, but the high correlation between the (0.53) makes these results tricky to interpret, particularly since, as dyad-level variables, their effects are identified off relatively few cases.

The Effects of Power

The balance of power between the states in the dyad has no systematic effect on dispute risk. Distance from the border segment to the closest national capital is negatively correlated with the risk of a dispute, though this effect is only statistically significant in the decade post-independence (Table 7, columns 1 and 3). This is consistent with Herbst's (2000) argument that the ability to exert control over territory diminishes with distance from the capital, but the effect is not very robust.

[23] To reinforce this point, we note that straight line boundaries are actually less likely partition groups than are river boundaries. This is because straight lines are often drawn through uninhabited areas (e.g., the Sahara), whereas groups may live on both banks of river.

6. A Spatial Regression Model

One potential concern about these results is that the estimation technique implicitly assumes that disputed segments are distributed randomly along the border, when in fact disputed (and undisputed) segments tend to be contiguous to one another. Indeed, the best predictor of whether a given segment is disputed is whether one or both of its neighbors are disputed. Above, we addressed this non-independence by clustering the standard errors by dyad, thereby relaxing the assumption of independence among observations within a given border. However, this technique does not explicitly capture the known spatial dependencies in the data. In this section, we implement an estimator that incorporates a spatial lag so that the outcome in each segment is made dependent on those in its neighbors. Although there are some costs to implementing this estimator, the results largely confirm those reported above.

A regression with a spatial lag takes the following form:

$$\mathbf{y} = \rho \mathbf{W}\mathbf{y} + \mathbf{X}\beta + \varepsilon \qquad (1)$$

where **y** is the Nx1 vector of observations on the dependent variable and **W** is an NxN spatial weight matrix. Each entry w_{ij} in **W** indicates the relative weight of outcome y_j on the outcome y_i. The **W** matrix is row normalized, so that the weights sum to one for each observation. The spatial weight matrix is set by the analyst to capture some assumed set of spatial relations, often capturing relative distance or contiguity. In the present application, where the observations are arrayed on a line, it is natural to assume that each segment is influenced by the segments on either side. For a line comprised of 5 segments, then, the spatial weight matrix would be as follows.

$$W = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 \\ 0.5 & 0 & 0.5 & 0 & 0 \\ 0 & 0.5 & 0 & 0.5 & 0 \\ 0 & 0 & 0.5 & 0 & 0.5 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

Notice that observations at the end points of the line only have one neighbor.

When the dependent variable is continuous and observed, this equation can be estimated in a straightforward manner.[24] If **y** is a latent variable and we only observe a dichotomous outcome, then the model becomes a probit with a spatial lag (Franzese and Hays 2008). Although such a model exists in principle and would be appropriate for our data, the spatial probit is quite difficult to estimate in practice.[25] Thus, we implement the linear model in (1), even though a model with a limited dependent variable would normally be preferred.

A secondary challenge is that, to model the spatial relations in our existing data would require a 76,000x76,000 spatial weight matrix, which is computationally impractical. Instead, we reduce the number of observations by aggregating 1km segments into larger zones that are identical in terms of their ethnic characteristics. We define an ethnic zone as a sequence of consecutive segments that have the same ethnic group or groups on both sides of the border. Thus, for example, if 100 consecutive segments partition a given ethnic group, we combine those segments into a single zone 100km in length. A new zone starts whenever the interstate border hits an ethnic

[24] We estimate the model using the SPATREG routine developed for Stata by Maurizio Pisati.
[25] Indeed, we tried. The challenge is that such a model has to evaluate high-dimensional multivariate normal distributions, which can only be done using numerical simulation techniques. Though we attempted to implement such an estimator using the MVNP package for Stata developed by Cappellari and Jenkins, the estimator consistently failed to converge.

boundary line, thus changing which, if any, group is partitioned by the line.[26] Zones also start and end at the endpoints of each dyadic boundary, so that each zone is a subset of only one interstate border.[27] When performed on the GREG data, this process yields 771 zones ranging in length from 2km to over 2000km, with average length of 100km; when performed on the Murdock data, we get 1454 zones ranging in length from 2 to 971km, with average length of 53km.

One virtue of this approach to reducing the number of observations is that each zone inherits the ethnic characteristic shared by every segment contained within it; there is no need to aggregate ethnic characteristics across some arbitrary subset of the border. Similarly, variables measured at the dyadic level are unchanged. For non-ethnic variables measured at the segment level, we calculate the average value across segments in each zone. So, for example, the straight line variable now indicates what fraction of the zone coincides with a straight line border, and the oil variable now indicates the fraction of segments within the zone that are within 50km of an oil deposit. Since zones vary considerably in their length, we also create and include a control for the length, in kilometers, of each zone.

For the dependent variable, the aggregation technique gives us the option of using a continuous measure of the percentage of the zone that was disputed or a dichotomous

[26] This technique creates a number of 1km ethnic zones, consisting of a single segment that has different ethnic characteristics from the segments on either side of it. These arise for two reasons. First, segments that intersect an ethnic boundary, and therefore mark the transition from one ethnic partition to another, appear different from those on either side. Second, small divergences between ethnic and interstate boundaries, such as can happen around winding rivers, can lead to 1km segments that interrupt a larger zone. Since there segments are artifacts of the mapping process, all 1km zones were dropped from the sample, and ethnically identical zones that had been interrupted were combined.

[27] There are also a few dyadic borders that consist of only a single ethnic zone, and the estimator requires that each observation have at least one neighbor. For the purposes of the tests performed here, we split these zones into two in order to keep them in the sample. None of the results change if these dyads are dropped.

indicator for whether any segment in the zone was disputed. In practice, the different between the two is very small. Of the 771 ethnic zone in the GREG data, 96 percent have either none (87 percent) or all (9 percent) of their segments disputed. Although the availability of a linear model might suggest that continuous measure is preferable, such a model forces us to assume that difference between 0 and 5 percent contested is identical to the difference between 95 and 100 percent, an assumption that is clearly belied by the distribution of outcomes. Thus, although we report estimates using both the continuous and dichotomous outcome measures, there is reason to prefer the latter.

Table 8 reports estimates obtained when the main results from the previous section are re-estimated using the spatial lag regression model.[28] Columns 1 and 2 replicate the model from Table 6, column 2, using the Murdock ethnic data to assess the effects of partitioned groups' jurisdictional hierarchy.[29] Columns 3 and 4 replicate the model from Table 4, column 2, using the GREG data to assess the effect of partitioned groups' access to state leadership. In both cases, the first column reports estimates using the continuous dependent variable measuring the proportion of the zone that was disputed, and the second column uses the dichotomous dependent variable indicating whether any segment with the zone was disputed.

In all models, the estimated spatial lag, captured by ρ, is large and statistically significant. This parameter can vary from -1 to 1, so the estimate value of in the vicinity of 0.7-0.9 reflects strong spatial dependencies in the data. Even so, the main results

[28] Robust standard errors are reported, though the SPATREG estimator does not permit clustering.
[29] Missing data creates a problem for the spatial regression, since each observation contributes to the likelihood of every other, so observations with missing values cannot be dropped. Unfortunately, we are missing data on the political characteristics of 2 percent of partitioned Murdock groups. To prevent these observations from dropping from the sample, we create an indicator for the missing observations and include this variable in the model. As the estimates in Table 9 show, the effect of partitioning a group with missing data is statistically indistinguishable from the base category, which corresponds to no partition.

pertaining to ethnic considerations continue to hold once this spatial lag is taken into account. This is particularly true of the models that use the dichotomous outcome indicator (columns 2 and 4). The estimated effects of group political organization follow the same pattern as depicted in Figure 11: the probability of a dispute increases with the jurisdictional hierarchy of the partitioned group, and borders that partition the least organized groups are less likely to be disputed than border that do not partition a group. The estimated effects of group access to leadership are similar to those depicted in Figure 9, with one exception. As before, partitioning a group that was kin to one of the states' first leaders is a significant risk factor, but the estimated coefficient on partition is no longer statistically significant, suggesting that borders that partition politically weaker groups are no less likely to be contested than those that do not partition a group, unlike what we found earlier. A few other new results emerge in these tests, though none are robust across specifications.

6. Conclusions

We have shown in this paper that there exists significant variation in territorial and border disputes both across and within dyads in Africa. We exploited this variation to explore the origins of territorial and border disputes and to assess the relative value of four different sets of arguments about their determinants. Overall, the results suggest that considerations about the desirability of unifying partitioned ethnic groups are the most consistently influential predictors of disputes. Ethnically homogenous states are the most likely to contest their borders and to do so on behalf of partitioned groups that are large and politically important. Ethnically heterogeneous states, on the other hand, appear

more reluctant to expand their borders, and claims for unification are unlikely to be made on behalf of small or poorly organized groups. Of the non-ethnic factors, the one that stands out most consistently is the relative stability of river borders, while the presence of resources had no or, in the case of oil, a conflict-reducing effect. There was also little consistent evidence that straight line or poorly delineated borders are a systematic risk factor, particularly once other factors are taken into account.

Such a finer grained understanding of the causes of territorial disputes is not just interesting in its own right; it also raises fundamental questions about the claims that states bring to inter-state bargaining. We have seen that claims to territory are generally limited and bounded. Though these claims may be strategically understated, it seems likely that preferences for territory are similarly limited and bounded. The patterns uncovered here suggest that just as there are pieces of territory that a state would like to possess, there are other pieces of territory that they would rather not possess. In particular, governments seem to have little desire to obtain territories whose annexation would unify politically marginal groups or exacerbate problems of ethnic heterogeneity. If state utilities are not strictly increasing in the territory they control, an assumption implicit in bargaining models, then conflict may be avoided not because states are deterred from challenging the status quo, but because they have no interest in changing it. This work suggests that much of the variation in conflict among states is rooted in domestic imperatives that determine whether and how much their territorial ambitions collide.

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Table 1
Summary of Bivariate Relationships

Variable	Percent Variable=1	Percent disputed| Variable=0	Percent disputed| Variable=1
Murdock_NS_partition	93.2	23.4	17.6
Murdock_S_partition	77.4	14	19.2
GREG_S_partition	73.8	17.1	18.3
Murdock_NS_partition_1stlead	11	17.7	20.5
Murdock_S_partition_1stlead	9.7	17.7	21.5
GREG_S_partition_1stlead	30	10.6	35.3
Murdock_S_partition_village	16.6	21.6	2.8
Murdock_S_partition_chiefdom	47.1	15.9	21.4
Murdock_S_partition_statelike	12.7	15.9	36.5
straight	30.9	12.2	31
river	29.3	22.4	7.5
lake	3.7	17.9	21.4
oil	3.6	18.3	10.8
minerals	18.9	18.1	17.9
ibs_dis	18.8	18.9	14.2
britishparents	12.8	15.9	32.7
frenchparents	31.2	16.6	21.2
interempire	53.5	18.5	17.6
intraempire	31.8	17.6	19

Table 2
The Effects of Group Partition Conditional on Political Access (Murdock_NS)

	(1)	(2)	(3)	(4)	(5)
partition	-0.056	-0.154	-0.091	-0.388	-0.131
	(0.540)	(0.525)	(0.528)	(0.576)	(0.538)
partition_1stlead		0.859*			
		(0.484)			
partition_capital			0.446		
			(0.515)		
partition_fraction				0.852	
				(0.841)	
maxgroupshare					0.688
					(1.059)
ethfrac_min	-4.832***	-4.985***	-4.734***	-4.735***	-4.730***
	(1.520)	(1.581)	(1.539)	(1.493)	(1.513)
lnborder_length	0.872**	0.924**	0.912**	1.068**	0.936**
	(0.424)	(0.435)	(0.422)	(0.486)	(0.439)
straight	0.225	0.262	0.251	0.159	0.236
	(0.352)	(0.346)	(0.350)	(0.362)	(0.350)
river	-1.058**	-0.987**	-1.076**	-1.112**	-1.086**
	(0.486)	(0.456)	(0.481)	(0.499)	(0.496)
oil	-1.345*	-1.232*	-1.292*	-1.271*	-1.268*
	(0.698)	(0.692)	(0.728)	(0.690)	(0.722)
minerals	-0.205	-0.163	-0.239	-0.203	-0.246
	(0.320)	(0.307)	(0.328)	(0.312)	(0.342)
mindist	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
balance0	0.512	0.673	0.546	0.546	0.595
	(0.915)	(0.910)	(0.905)	(0.913)	(0.934)
ibs_discalimer	0.631	0.585	0.639	0.668	0.645
	(0.879)	(0.895)	(0.881)	(0.876)	(0.881)
britishparents	2.182*	2.232*	2.177*	2.251*	2.206*
	(1.157)	(1.174)	(1.155)	(1.159)	(1.161)
frenchparents	0.794	0.830	0.802	0.782	0.775
	(0.830)	(0.847)	(0.831)	(0.829)	(0.833)
interempire	1.786	2.006	1.834	1.873	1.877
	(1.521)	(1.616)	(1.514)	(1.520)	(1.572)
intraempire	0.679	0.862	0.704	0.722	0.767
	(1.411)	(1.432)	(1.392)	(1.380)	(1.426)
Constant	-6.434**	-7.134**	-6.889**	-7.822**	-7.114**
	(3.206)	(3.371)	(3.176)	(3.713)	(3.502)
Observations	76685	76685	76685	76685	76685
Chi2	23.73	24.19	26.78	23.87	23.84

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3
The Effects of Group Partition Conditional on Political Access (Murdock_S)

	(1)	(2)	(3)	(4)	(5)
partition	0.321	0.195	0.243	0.030	0.202
	(0.277)	(0.269)	(0.266)	(0.279)	(0.286)
partition_1stlead		0.850*			
		(0.472)			
partition_capital			0.591		
			(0.537)		
partition_fraction				0.878	
				(0.826)	
maxgroupshare					0.904
					(1.026)
ethfrac_min	-4.794***	-4.937***	-4.718***	-4.724***	-4.718***
	(1.502)	(1.550)	(1.515)	(1.482)	(1.501)
lnborder_length	0.838**	0.890**	0.880**	0.987**	0.900**
	(0.418)	(0.426)	(0.414)	(0.446)	(0.423)
straight	0.239	0.268	0.265	0.184	0.250
	(0.356)	(0.351)	(0.352)	(0.368)	(0.353)
river	-1.069**	-1.017**	-1.092**	-1.116**	-1.101**
	(0.489)	(0.466)	(0.481)	(0.497)	(0.498)
oil	-1.384**	-1.280*	-1.343*	-1.327*	-1.319*
	(0.702)	(0.695)	(0.746)	(0.699)	(0.727)
minerals	-0.197	-0.155	-0.243	-0.186	-0.247
	(0.319)	(0.305)	(0.329)	(0.310)	(0.340)
mindist	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
balance0	0.471	0.621	0.510	0.473	0.571
	(0.903)	(0.893)	(0.890)	(0.891)	(0.912)
ibs_disclaimer	0.615	0.566	0.620	0.638	0.624
	(0.885)	(0.898)	(0.887)	(0.883)	(0.887)
britishparents	2.178*	2.214*	2.160*	2.222*	2.184*
	(1.160)	(1.174)	(1.162)	(1.150)	(1.165)
frenchparents	0.790	0.823	0.790	0.773	0.757
	(0.826)	(0.841)	(0.829)	(0.824)	(0.836)
interempire	1.757	1.950	1.839	1.843	1.885
	(1.509)	(1.599)	(1.511)	(1.507)	(1.583)
intraempire	0.672	0.838	0.738	0.739	0.814
	(1.401)	(1.426)	(1.385)	(1.376)	(1.440)
Constant	-6.503**	-7.143**	-6.966**	-7.577**	-7.181**
	(3.164)	(3.306)	(3.126)	(3.413)	(3.354)
Observations	76685	76685	76685	76685	76685
Chi2	26.29	28.31	31.57	26.58	27.83

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4
The Effects of Group Partition Conditional on Political Access (GREG_S)

	(1)	(2)	(3)	(4)	(5)
partition	-0.072	-0.739*	-0.636	-1.388**	-0.800
	(0.374)	(0.426)	(0.434)	(0.581)	(0.498)
partition_1stlead		1.247***			
		(0.403)			
partition_capital			1.042**		
			(0.430)		
partition_fraction				2.411***	
				(0.926)	
maxgroupshare					1.536**
					(0.739)
ethfrac_min	-4.849***	-4.158***	-3.960***	-3.498**	-3.582***
	(1.512)	(1.377)	(1.367)	(1.368)	(1.364)
lnborder_length	0.874**	0.716*	0.792**	0.841**	0.778**
	(0.419)	(0.380)	(0.397)	(0.361)	(0.383)
straight	0.225	0.310	0.364	0.264	0.351
	(0.351)	(0.343)	(0.341)	(0.365)	(0.350)
river	-1.058**	-0.875*	-0.999**	-0.965**	-0.958**
	(0.489)	(0.470)	(0.475)	(0.486)	(0.481)
oil	-1.337*	-1.568**	-1.399**	-1.752**	-1.548**
	(0.707)	(0.758)	(0.707)	(0.748)	(0.723)
minerals	-0.201	-0.191	-0.236	-0.344	-0.293
	(0.328)	(0.317)	(0.322)	(0.326)	(0.327)
mindist	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
balance0	0.499	0.697	0.562	0.451	0.581
	(0.905)	(0.858)	(0.896)	(0.889)	(0.889)
ibs_disclaimer	0.635	0.561	0.579	0.289	0.501
	(0.870)	(0.880)	(0.875)	(0.921)	(0.850)
britishparents	2.179*	1.946*	2.013*	1.966*	1.953*
	(1.157)	(1.093)	(1.097)	(1.024)	(1.067)
frenchparents	0.802	0.663	0.657	0.506	0.604
	(0.826)	(0.804)	(0.787)	(0.740)	(0.776)
interempire	1.792	1.612	1.571	1.276	1.540
	(1.528)	(1.483)	(1.450)	(1.378)	(1.460)
intraempire	0.673	0.592	0.568	0.522	0.625
	(1.401)	(1.358)	(1.342)	(1.272)	(1.340)
Constant	-6.432**	-5.715*	-6.288**	-6.554**	-6.340**
	(3.204)	(2.953)	(3.091)	(2.828)	(3.039)
Observations	76685	76685	76685	76685	76685
Chi2	25.39	25.44	23.43	26.98	23.16

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5
Territorial Disputes Involving Partitioned Groups that Produced a First State Leader

Dyad (Challenger in **bold**)	**Partitioned Group**	**First Leader**	**State of Leader**
Algeria-**Tunisia**	Arab	Bourguiba	Tunisia
Benin-Niger	Songai	Diori	Niger
Cote d'Ivoire-**Ghana**	Akan	Nkrumah	Ghana
Ethiopia-Eritrea	Tigrai	Afeworki	Eritrea
Ethiopia-Sudan	Arab	Al-Azhari	Sudan
Ghana-Togo	Ewe	Olympio	Togo
Kenya-**Somalia**	Somali	Osman Daar	Somalia
Morocco-Algeria	Arab	Mohammed V	Morocco
Morocco-Mauritania (Western Sahara)	Arab	Mohammed V	Morocco
Morocco-Mauritania (Mauritania)	Arab	Mohammed V	Morocco
Mali-Mauritania (Eastern Hodh)	Arab	Ould Daddah	Mauritania
South Africa-**Lesotho**	Basuto	Jonathan	Lesotho
South Africa-**Swaziland**	Swazi	Sobhuza	Swaziland
Somalia-Ethiopia	Somali	Osman Daar	Somalia
Zambia-**Malawi**	Malavi	Banda	Malawi

Table 6
The Effects of Group Partition Conditional on Jurisdictional Hierarchy

	(1) Murdock_NS	(2) Murdock_S
partition_village	-1.998**	-1.692***
	(0.806)	(0.586)
partition_chiefdom	0.154	0.583*
	(0.560)	(0.321)
partition_statelike	0.208	0.696
	(0.699)	(0.477)
ethfrac_min	-4.715***	-4.598***
	(1.466)	(1.422)
lnborder_length	0.992**	0.915**
	(0.423)	(0.409)
straight	0.287	0.299
	(0.363)	(0.372)
river	-0.902**	-0.950**
	(0.451)	(0.455)
oil	-1.537**	-1.591**
	(0.728)	(0.740)
minerals	-0.319	-0.287
	(0.319)	(0.326)
mindist	-0.001*	-0.001
	(0.001)	(0.001)
balance0	0.690	0.624
	(0.826)	(0.822)
ibs_disclaimer	0.673	0.621
	(0.839)	(0.849)
britishparents	2.064*	1.977*
	(1.095)	(1.100)
frenchparents	0.798	0.774
	(0.791)	(0.796)
interempire	1.742	1.677
	(1.395)	(1.369)
intraempire	0.491	0.545
	(1.284)	(1.273)
Constant	-7.126**	-6.963**
	(3.146)	(3.051)
Observations	72925	73462
Chi2	45.19	45.94

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7
Determinants of Early vs. Late Disputes

	(1) Murdock_S Dispute early	(2) Murdock_S Dispute late	(3) GREG_S Dispute early	(4) GREG_S Dispute late	
partition_village	-1.342**	†	-0.260	-1.008**	partition
	(0.565)		(0.615)	(0.394)	
partition_chiefdom	0.596	0.605	1.268**	-0.571	partition_captial
	(0.410)	(0.415)	(0.503)	(0.935)	
partition_statelike	0.510	0.538			
	(0.486)	(1.324)			
ethfrac_min	-5.362***	-2.372	-4.575***	-2.106	ethfrac_min
	(1.791)	(3.105)	(1.594)	(3.200)	
lnborder_length	1.016**	0.305	0.913**	0.069	lnborder_length
	(0.485)	(0.872)	(0.455)	(0.671)	
straight	0.003	1.155*	0.198	0.932	straight
	(0.427)	(0.640)	(0.409)	(0.727)	
river	-0.903	-1.982**	-0.935	-2.292***	river
	(0.557)	(0.778)	(0.569)	(0.750)	
oil	-1.524**	†	-1.548**	†	oil
	(0.717)		(0.695)		
minerals	-0.640	0.679	-0.661	0.761*	minerals
	(0.396)	(0.418)	(0.423)	(0.456)	
mindist	-0.002**	0.001	-0.002***	0.001	mindist
	(0.001)	(0.001)	(0.001)	(0.001)	
balance	-0.629	1.498	-0.625	1.069	balance
	(0.860)	(2.023)	(0.850)	(1.862)	
ibs_disclaimer	0.703	1.988**	0.607	2.340**	ibs_disclaimer
	(1.006)	(0.960)	(0.994)	(0.948)	
britishparents	1.937	0.867	1.691	1.046	britishparents
	(1.440)	(0.973)	(1.497)	(1.013)	
frenchparents	1.434*	-4.055	1.218	-4.464*	frenchparents
	(0.841)	(2.799)	(0.826)	(2.570)	
interempire	1.950	1.543	1.652	1.332	interempire
	(1.891)	(1.978)	(1.917)	(1.963)	
intraempire	0.577	2.762	0.560	2.579	intraempire
	(1.536)	(2.713)	(1.547)	(2.203)	
Constant	-7.007*	-7.152	-6.831*	-4.471	Constant
	(3.602)	(6.803)	(3.514)	(5.030)	
Observations	73462	48030	76685	62356	Observations
Chi2	43.00	145.64	32.86	90.14	Chi2

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1 † variable=1 perfectly predicts no dispute

Table 8
Spatial Regression Models

	(1) Murdock_S Continuous	(2) Murdock_S Dichotomous	(3) GREG_S Continuous	(4) GREG_S Dichotomous	
partition_village	-0.010	-0.011	-0.004	-0.013	partition
	(0.007)	(0.011)	(0.012)	(0.015)	
partition_chiefdom	-0.001	0.021**	0.021	0.052**	partition_1stlead
	(0.007)	(0.009)	(0.020)	(0.023)	
partition_statelike	0.006	0.033**			
	(0.010)	(0.015)			
partition_missing	-0.009	-0.015			
	(0.007)	(0.010)			
ethfrac_min	-0.042***	-0.054**	-0.078*	-0.090*	ethfrac_min
	(0.015)	(0.024)	(0.043)	(0.047)	
lnborder_length	0.010**	0.015**	0.010	0.013	lnborder_length
	(0.005)	(0.007)	(0.011)	(0.014)	
length of zone	-0.001	0.007**	-0.002	0.010*	length of zone
	(0.002)	(0.003)	(0.006)	(0.006)	
straight	0.008	0.008	0.019	0.018	straight
	(0.009)	(0.011)	(0.018)	(0.020)	
river	-0.011**	-0.014**	-0.011	-0.009	river
	(0.005)	(0.006)	(0.012)	(0.015)	
oil	-0.005	-0.004	-0.002	0.060	oil
	(0.012)	(0.027)	(0.043)	(0.075)	
minerals	-0.006	-0.004	0.003	0.012	minerals
	(0.007)	(0.009)	(0.017)	(0.021)	
mindist	-0.000*	-0.000*	-0.000	-0.000	mindist
	(0.000)	(0.000)	(0.000)	(0.000)	
ibs disclaimer	0.020**	0.016	0.024	0.012	ibs disclaimer
	(0.008)	(0.012)	(0.019)	(0.021)	
balance0	-0.008	-0.009	-0.001	0.005	balance0
	(0.006)	(0.013)	(0.016)	(0.026)	
britishparents	0.029**	0.043**	0.034	0.039	britishparents
	(0.014)	(0.019)	(0.031)	(0.032)	
frenchparents	-0.003	0.004	-0.022	-0.020	frenchparents
	(0.007)	(0.009)	(0.016)	(0.019)	
intraempire	0.006	0.005	0.007	-0.002	intraempire
	(0.014)	(0.019)	(0.032)	(0.034)	
interempire	0.014	0.017	0.010	0.001	interempire
	(0.010)	(0.012)	(0.021)	(0.022)	
Constant	-0.026	-0.074*	0.017	-0.023	Constant
	(0.029)	(0.044)	(0.064)	(0.089)	
ρ	0.879***	0.825***	0.732***	0.693***	ρ
	(0.014)	(0.020)	(0.032)	(0.033)	
Observations	1454	1454	771	771	Observations

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 1
African Territorial Disputes

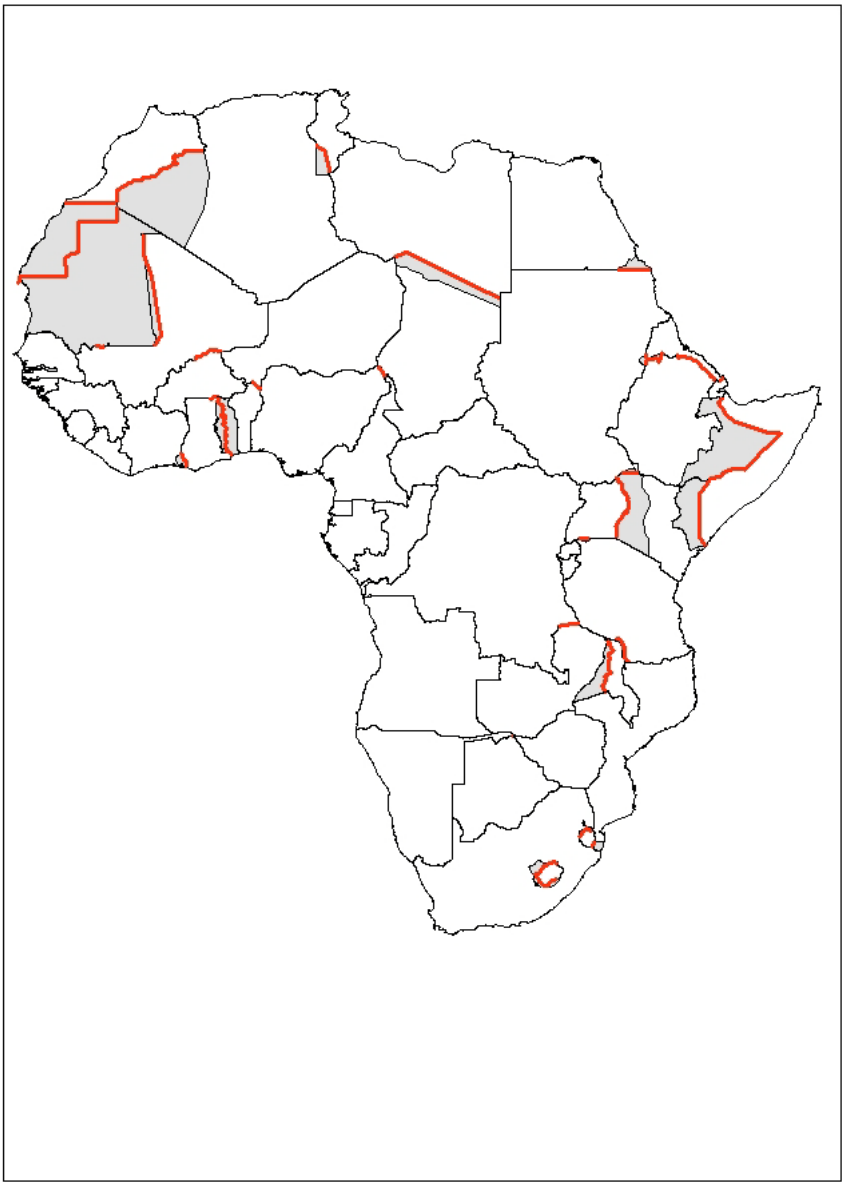


Figure 2
African Territorial Disputes and the Murdock (1967) Ethnic Map

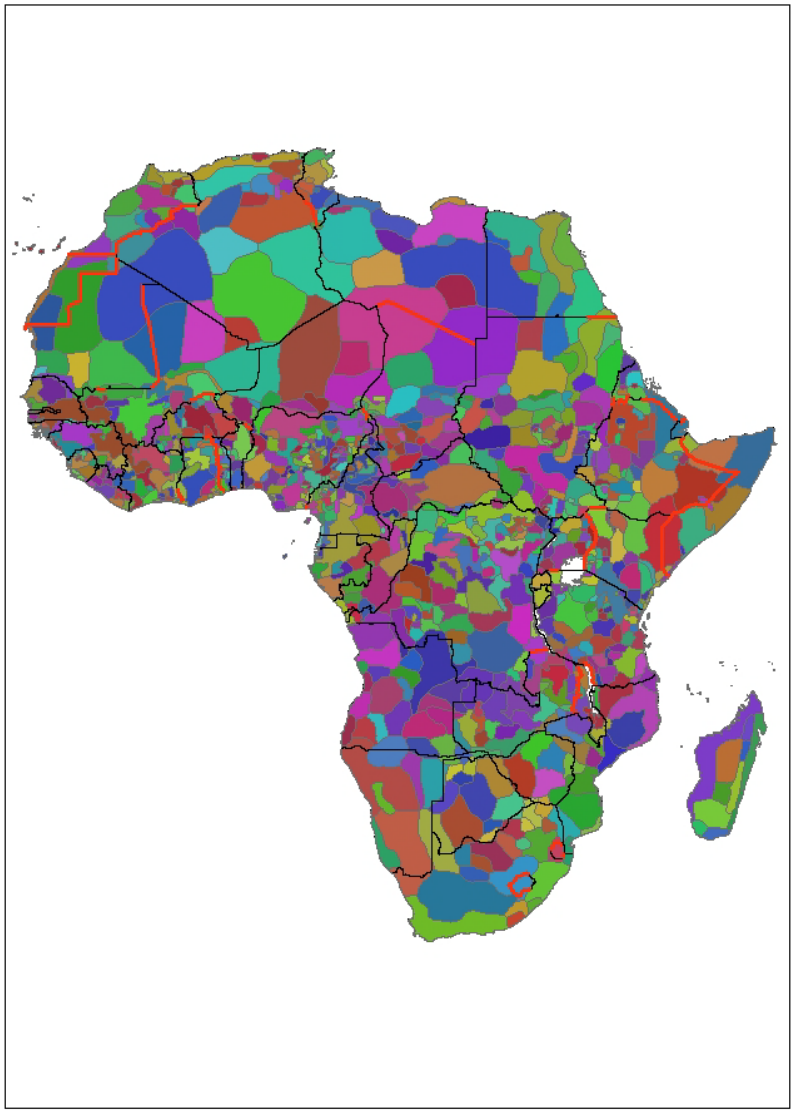


Figure 3
African Territorial Disputes and the Soviet Ethnic Map(GREG)

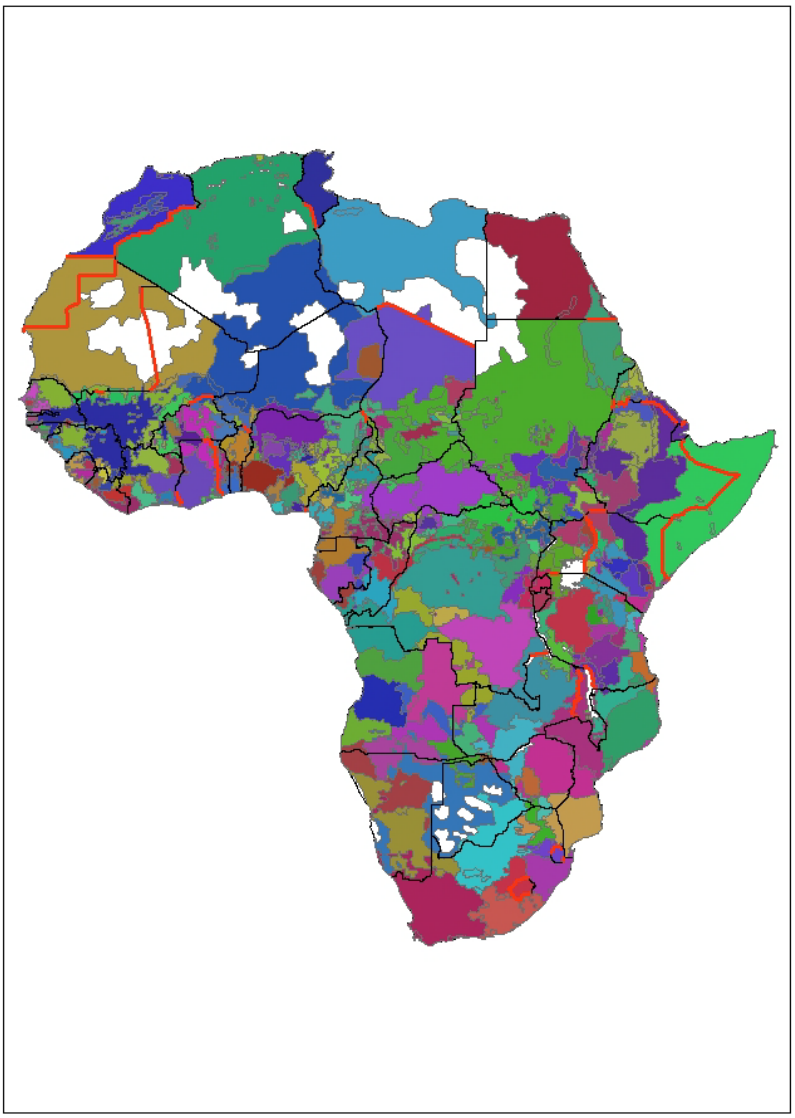


Figure 4
Variation in Claim Size by Area

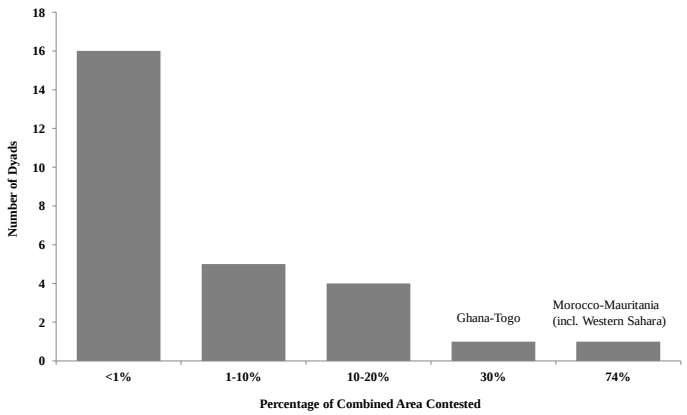


Figure 5
Variation in Claim Size by Length

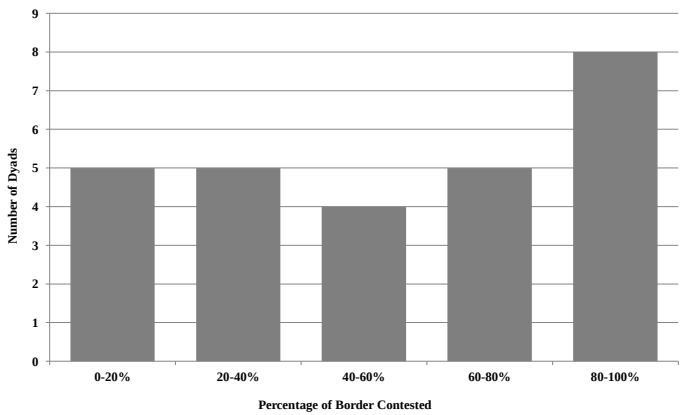


Figure 6
A Thing of the Past? Dispute Length and Year of Onset

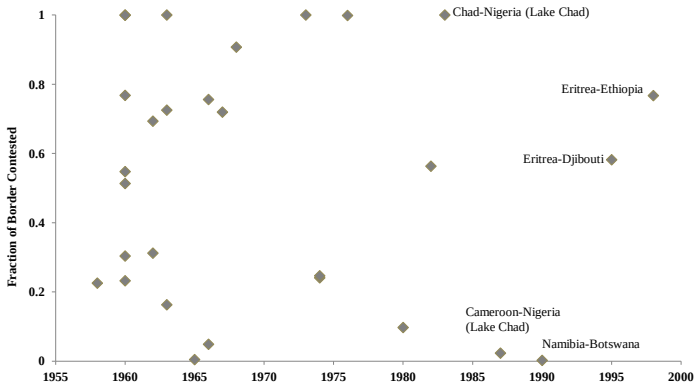


Figure 7
Claim Area and Age of Border at Onset

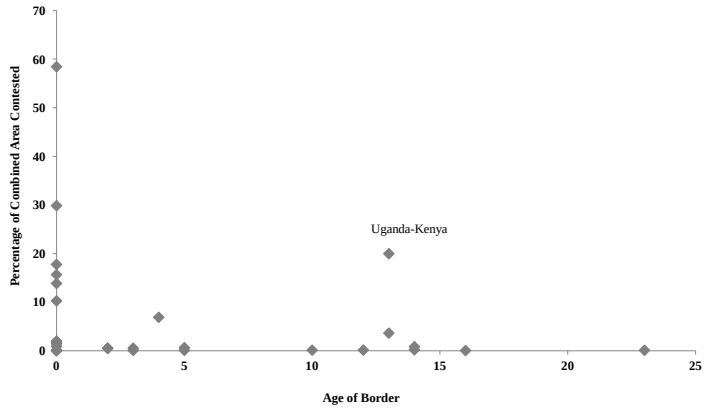


Figure 8
Power Balance and Area Contested

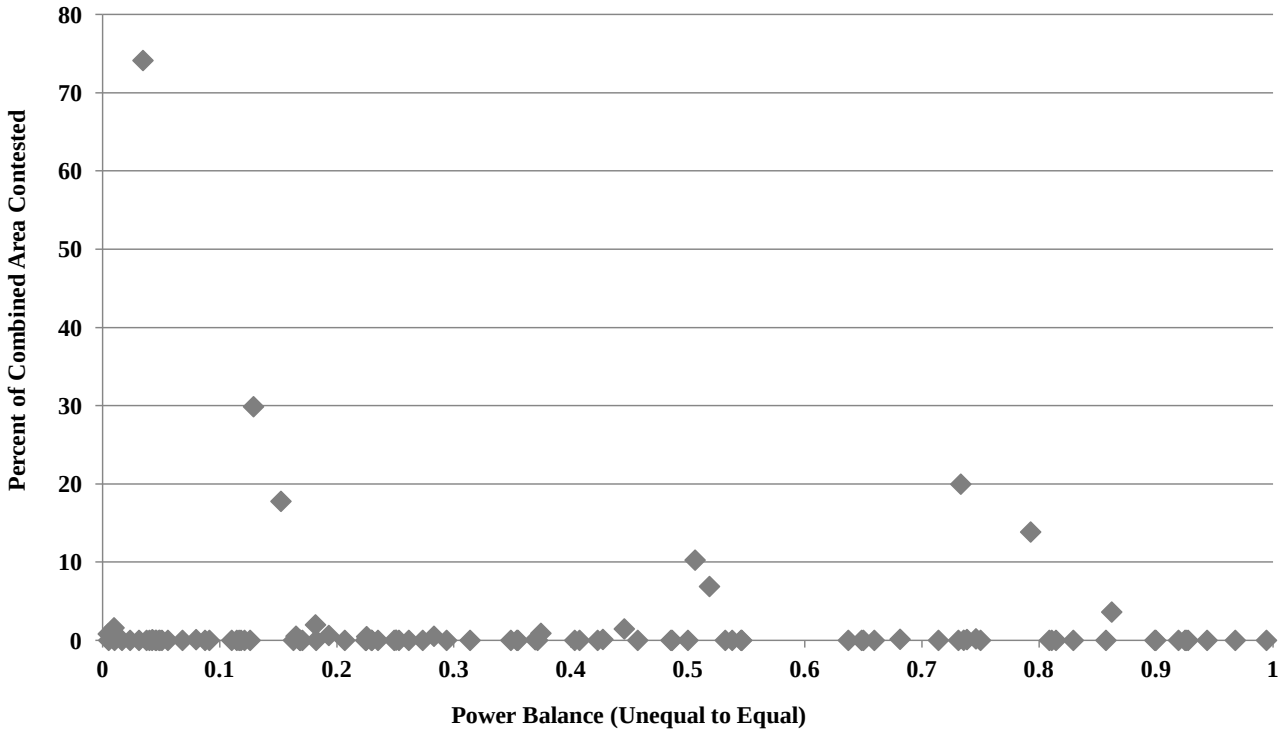
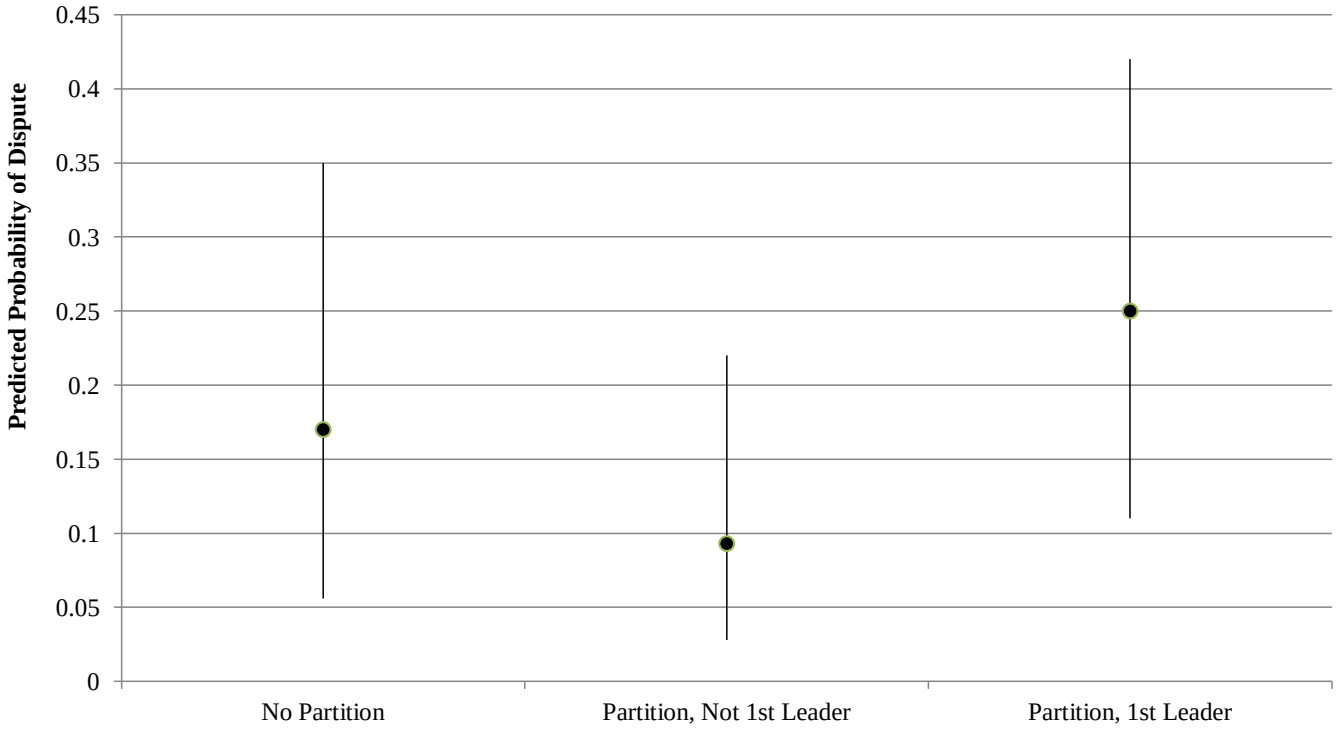
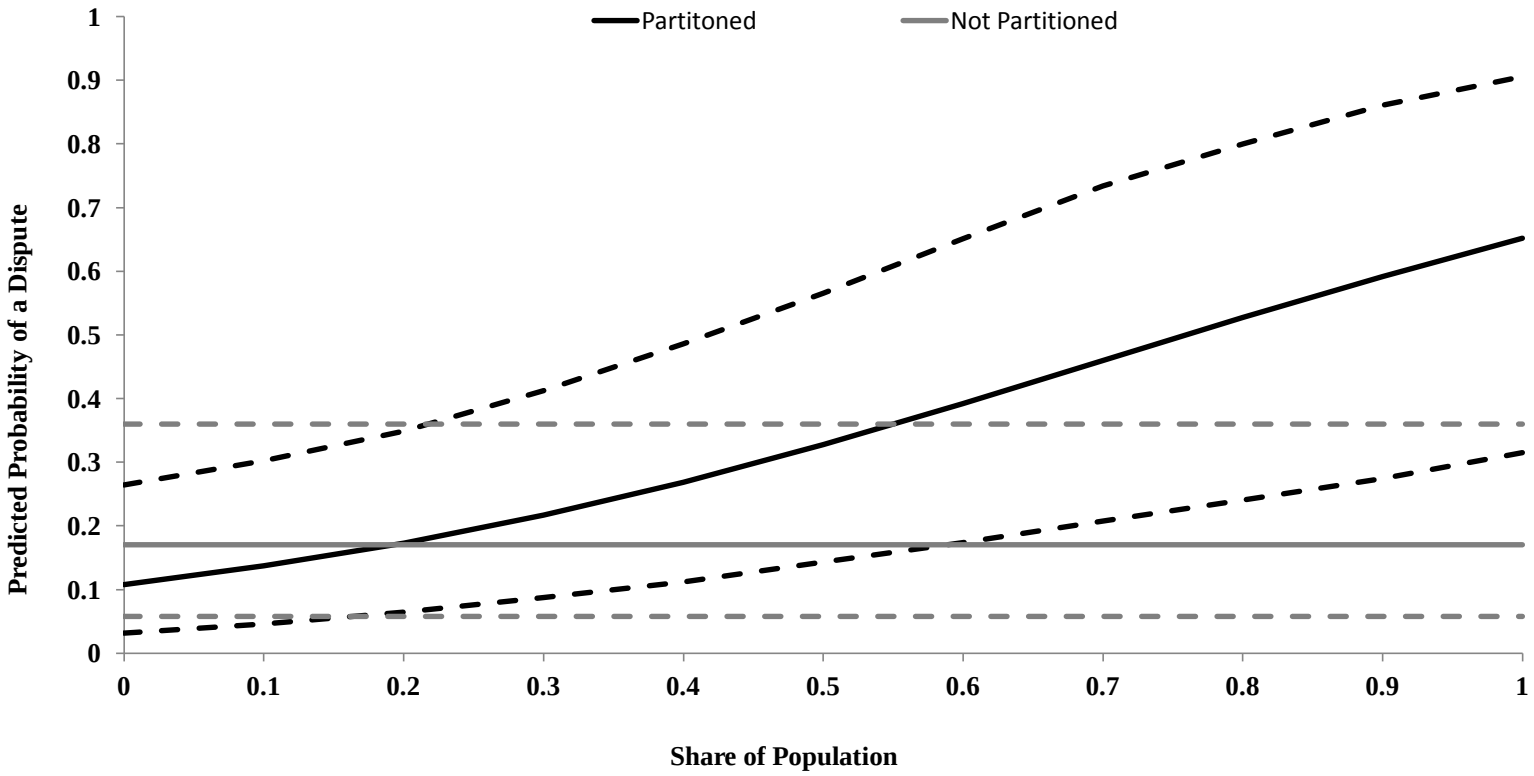


Figure 9
The Predicted Probability of a Dispute as a Function of Partition and Power



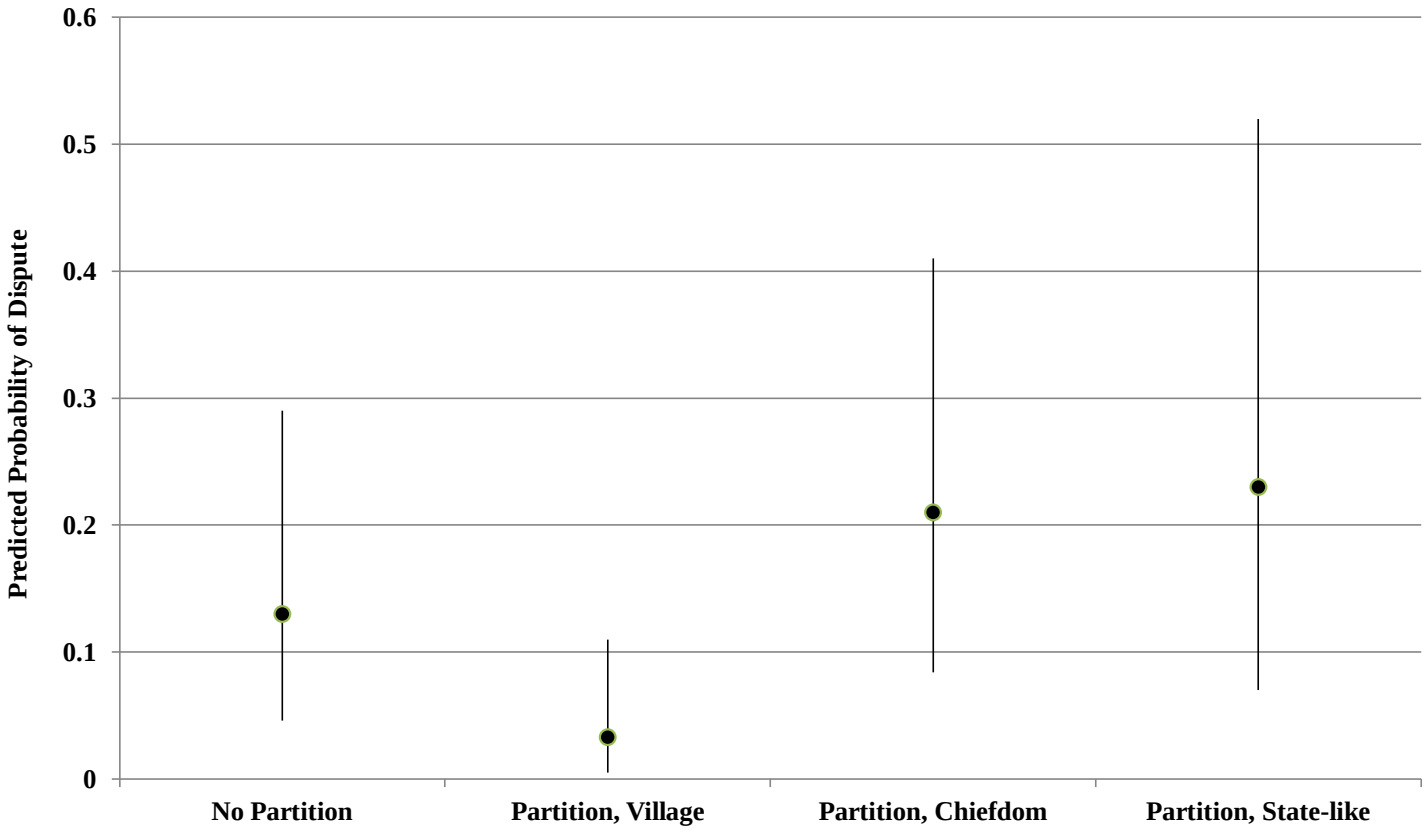
Note: This figure depicts the predicted probability that a segment will be disputed under the specified conditions, using the estimates from Table 4, column 2. 95 percent confidence intervals, calculated using CLARIFY, are shown.

Figure 10
The Predicted Probability of a Dispute as a Function of Partition and Group Size



Note: This figure depicts the predicted probability that a segment will be disputed as a function of whether it partitions a group and, if so, the population share of that group, using the estimates from Table 5, column 4. 95 percent confidence intervals, calculated using CLARIFY, are shown is dashed lines.

Figure 11
The Predicted Probability of a Dispute as a Function of Partition and Political Organization



Note: This figure depicts the predicted probability that a segment will be disputed under the specified conditions, using the estimates from Table 6, column 1. 95 percent confidence intervals, calculated using CLARIFY, are shown.